# Edexcel GCE
# Statistics S2
# Gold Level G2
# (Question Paper)


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Paper Reference(s)

# 6684/01

# Edexcel GCE

## Statistics S2

## Gold Level G2

## Time: 1 hour 30 minutes

| **Materials required for examination papers** | **Items included with question** |
|---|---|
| Mathematical Formulae (Green) | Nil |

**Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulas stored in them.**

### Instructions to Candidates

Write the name of the examining body (Edexcel), your centre number, candidate number, the unit title (Statistics S2), the paper reference (6684), your surname, initials and signature.

### Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
There are 8 questions in this question paper. The total mark for this paper is 75.

### Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the Examiner. Answers without working may gain no credit.

**Suggested grade boundaries for this paper:**

| A* | A | B | C | D | E |
|---|---|---|---|---|---|
| **65** | **55** | **47** | **36** | **26** | **17** |

**1.** A bag contains a large number of counters. A third of the counters have a number 5 on them and the remainder have a number 1.

A random sample of 3 counters is selected.

(*a*) List all possible samples.

**(2)**

(*b*) Find the sampling distribution for the range.

**(3)**

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**2.** A test statistic has a distribution B(25, *p*).

Given that

$$H_0 : p = 0.5, \quad H_1 : p \neq 0.5,$$

(*a*) find the critical region for the test statistic such that the probability in each tail is as close as possible to 2.5%.

**(3)**

(*b*) State the probability of incorrectly rejecting $H_0$ using this critical region.

**(2)**

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**3.** Bacteria are randomly distributed in a river at a rate of 5 per litre of water. A new factory opens and a scientist claims it is polluting the river with bacteria. He takes a sample of 0.5 litres of water from the river near the factory and finds that it contains 7 bacteria. Stating your hypotheses clearly test, at the 5% level of significance, the claim of the scientist.

**(7)**

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**4.** Past records suggest that 30% of customers who buy baked beans from a large supermarket buy them in single tins. A new manager questions whether or not there has been a change in the proportion of customers who buy baked beans in single tins. A random sample of 20 customers who had bought baked beans was taken.

(*a*) Using a 10% level of significance, find the critical region for a two-tailed test to answer the manager's question. You should state the probability of rejection in each tail which should be less than 0.05.

**(5)**

(*b*) Write down the actual significance level of a test based on your critical region from part (*a*).

**(1)**

The manager found that 11 customers from the sample of 20 had bought baked beans in single tins.

(*c*) Comment on this finding in the light of your critical region found in part (*a*).

**(2)**

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**5.** In a game, players select sticks at random from a box containing a large number of sticks of different lengths. The length, in cm, of a randomly chosen stick has a continuous uniform distribution over the interval [7, 10].

A stick is selected at random from the box.

(*a*) Find the probability that the stick is shorter than 9.5 cm.

**(2)**

To win a bag of sweets, a player must select 3 sticks and wins if the length of the longest stick is more than 9.5 cm.

(*b*) Find the probability of winning a bag of sweets.

**(2)**

To win a soft toy, a player must select 6 sticks and wins the toy if more than four of the sticks are shorter than 7.6 cm.

(*c*) Find the probability of winning a soft toy.

**(4)**

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**6.** A company has a large number of regular users logging onto its website. On average 4 users every hour fail to connect to the company's website at their first attempt.

(*a*) Explain why the Poisson distribution may be a suitable model in this case.
**(1)**

Find the probability that, in a randomly chosen **2 hour** period,

(*b*) (i) all users connect at their first attempt,

(ii) at least 4 users fail to connect at their first attempt.
**(5)**

The company suffered from a virus infecting its computer system. During this infection it was found that the number of users failing to connect at their first attempt, over a 12 hour period, was 60.

(*c*) Using a suitable approximation, test whether or not the mean number of users per hour who failed to connect at their first attempt had increased. Use a 5% level of significance and state your hypotheses clearly.
**(9)**

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**7.** (*a*) Define the critical region of a test statistic.
**(2)**

A discrete random variable $X$ has a Binomial distribution B(30, $p$). A single observation is used to test $H_0 : p = 0.3$ against $H_1 : p \neq 0.3$

(*b*) Using a 1% level of significance find the critical region of this test. You should state the probability of rejection in each tail which should be as close as possible to 0.005.
**(5)**

(*c*) Write down the actual significance level of the test.
**(1)**

The value of the observation was found to be 15.

(*d*) Comment on this finding in light of your critical region.
**(2)**

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**8.** The continuous random variable $X$ has probability density function given by

$$f(x) = \begin{cases} \frac{3}{32}(x-1)(5-x) & 1 \le x \le 5, \\ 0 & \text{otherwise.} \end{cases}$$

($a$) Sketch f($x$) showing clearly the points where it meets the $x$-axis.
**(2)**

($b$) Write down the value of the mean, $\mu$, of $X$.
**(1)**

($c$) Show that $E(X^2) = 9.8$.
**(4)**

($d$) Find the standard deviation, $\sigma$, of $X$.
**(2)**

The cumulative distribution function of $X$ is given by

$$F(x) = \begin{cases} 0 & x < 1 \\ \frac{1}{32}(a - 15x + 9x^2 - x^3) & 1 \le x \le 5 \\ 1 & x > 5 \end{cases}$$

where $a$ is a constant.

($e$) Find the value of $a$.
**(2)**

($f$) Show that the lower quartile of $X$, $q_1$, lies between 2.29 and 2.31.
**(3)**

($g$) Hence find the upper quartile of $X$, giving your answer to 1 decimal place.
**(1)**

($h$) Find, to 2 decimal places, the value of $k$ so that

$$P(\mu - k\sigma < X < \mu + k\sigma) = 0.5.$$
**(2)**

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**TOTAL FOR PAPER: 75 MARKS**

**END**